

Claims

1. A method for determining the concentration of a first, medically significant component of a biological fluid or a control, the biological fluid or control including a second component which affects the determination of the concentration of the first component, the method including performing a first measurement on the biological fluid or control which first measurement varies with both the concentration of the first component and at least one of the presence and concentration of the second component, performing a second measurement on the biological fluid or control which second measurement also varies with the at least one of the presence and concentration of the second component to develop an indication of the at least one of the presence and concentration of the second component, and removing an amount representative of the indicated presence or concentration of the second component from the concentration of the first component indicated by the first measurement.
- 15 2. The method of claim 1 wherein the biological fluid is blood or a blood fraction.
3. The method of claim 2 wherein the first component is glucose.
4. The method of claim 3 wherein the second component is blood cells.
- 20 5. The method of claim 4 wherein the second measurement is of a largely glucose-insensitive measure of hematocrit.
6. The method of claim 5 wherein the first measurement is of a hematocrit-sensitive measure of glucose concentration.
7. The method of claim 1 further including contacting the biological fluid or control with a reactant before performing the first measurement.
- 25 8. The method of claim 7 wherein the biological fluid is blood or a blood fraction.
9. The method of claim 8 wherein the first component is glucose.
10. The method of claim 9 wherein the second component
- 30 is blood cells.
11. The method of claim 10 wherein the second measurement is of a largely glucose-insensitive measure of hematocrit.

12. The method of claim 11 wherein the first measurement is of a hematocrit-sensitive measure of glucose concentration.

13. The method of claim 7 wherein the first and second measurements exhibit an interdependence between the concentration of the first component and the concentration of the second component.

14. The method of claim 13 wherein the biological fluid is blood or a blood fraction.

15. The method of claim 14 wherein the first component is glucose.

16. The method of claim 15 wherein the second component is blood cells.

17. The method of claim 16 wherein the second measurement is of a largely glucose-insensitive measure of hematocrit.

18. The method of claim 17 wherein the first measurement is of a hematocrit-sensitive measure of glucose concentration.

19. The method of claim 1 wherein the first and second measurements exhibit an interdependence between the concentration of the first component and the concentration of the second component.

20. The method of claim 19 wherein the biological fluid is blood or a blood fraction.

21. The method of claim 20 wherein the first component is glucose.

22. The method of claim 21 wherein the second component is blood cells.

23. The method of claim 22 wherein the second measurement is of a largely glucose-insensitive measure of hematocrit.

24. The method of claim 23 wherein the first measurement is of a hematocrit-sensitive measure of the glucose concentration.

25. The method of claim 1 wherein performing a first measurement on the biological fluid or control which first measurement varies with both the concentration of the first component and at least one of the presence and concentration of the second component includes performing measurements of a time-varying function $i_1(t)$ having the general form

$$i_1(t) = M/\sqrt{t} + B$$

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where t is time from initiating the measurement, M is the slope of a graph of the function and B is a value the function approaches as t becomes very large.

26. The method of claim 1 wherein performing a second measurement on the biological fluid or control which second measurement varies primarily only with the at least one of the presence and concentration of the second component to develop an indication of the at least one of the presence and concentration of the second component includes performing at least one measurement of a time-varying function $i_2(t)$, where t is time, $t <$ some arbitrarily established time.

27. The method of claim 1 wherein performing a first measurement on the biological fluid or control which first measurement varies with both the concentration of the first component and at least one of the presence and concentration of the second component, performing a second measurement on the biological fluid or control which second measurement varies primarily only with the at least one of the presence and concentration of the second component to develop an indication of the at least one of the presence and concentration of the second component, and removing an amount representative of the indicated presence or concentration of the second component from the concentration of the first component indicated by the first measurement together include performing measurements of a time-varying function $i_1(t)$ having the general form

$$i_1(t) = M/\sqrt{t} + B$$

where t is time from initiating the measurement, M is the slope of a graph of the function and B is a value the function approaches as t becomes very large, performing at least one measurement of $i_2(t)$, $t <$ some arbitrarily established time, and removing from the measurements of $i_1(t)$ the at least one measurement of $i_2(t)$.

28. Apparatus for determining the concentration of a first, medically significant component of a biological fluid or a control, the biological fluid or control including a second component which affects the determination of the concentration of the first component, the apparatus including a device for performing a first measurement on the biological fluid or control which first measurement varies with both the concentration of the first component and at least one of the presence and concentration of the second component, performing a second measurement on the biological fluid or control which second measurement varies primarily only with the

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at least one of the presence and concentration of the second component to develop an indication of the at least one of the presence and concentration of the second component, and removing an amount representative of the indicated presence or concentration of the second component from the concentration of the first component indicated by the first measurement.

5 29. The apparatus of claim 28 for determining the concentration of a first, medically significant component of blood, a blood fraction or a control.

10 30. The apparatus of claim 29 for performing the first measurement on the blood, blood fraction or control which first measurement varies with both the concentration of glucose and the concentration of blood cells in blood, a blood fraction or a control.

15 31. The apparatus of claim 30 for performing the second measurement on the blood, blood fraction or control which second measurement varies primarily only with the concentration of blood cells in the blood, blood fraction or control.

32. The apparatus of claim 31 for performing the second measurement of a largely glucose-insensitive measure of hematocrit.

33. The apparatus of claim 32 for performing the first measurement of a hematocrit-sensitive measure of glucose concentration.

20 34. The apparatus of claim 28 further including a reactant for contacting the biological fluid or control before performing the first measurement.

35. The apparatus of claim 34 for determining the concentration of a first, medically significant component of blood, a blood fraction or a control.

25 36. The apparatus of claim 35 for performing the first measurement on the blood, blood fraction or control which first measurement varies with both the concentration of glucose and the concentration of blood cells in blood, a blood fraction or a control.

30 37. The apparatus of claim 36 for performing the second measurement on the blood, blood fraction or control which second measurement varies primarily only with the concentration of blood cells in the blood, blood fraction or control.

38. The apparatus of claim 37 for performing the second measurement of a largely glucose-insensitive measure of hematocrit.

39. The apparatus of claim 38 for performing the first measurement of a hematocrit-sensitive measure of glucose concentration.

5 40. The apparatus of claim 34 for performing first and second measurements which exhibit an interdependence between the concentration of the first component and the concentration of the second component.

41. The apparatus of claim 40 for determining the concentration of a first, medically significant component of blood, a blood fraction or a control.

10 42. The apparatus of claim 41 for performing the first measurement on the blood, blood fraction or control which first measurement varies with both the concentration of glucose and the concentration of blood cells in blood, a blood fraction or a control.

15 43. The apparatus of claim 42 for performing the second measurement on the blood, blood fraction or control which second measurement varies primarily only with the concentration of blood cells in the blood, blood fraction or control.

44. The apparatus of claim 43 for performing the second measurement of a largely glucose-insensitive measure of hematocrit.

20 45. The apparatus of claim 44 for performing the first measurement of a hematocrit-sensitive measure of glucose concentration.

46. The apparatus of claim 28 for performing first and second measurements which exhibit an interdependence between the concentration of the first component and the concentration of the second component.

25 47. The apparatus of claim 46 for determining the concentration of a first, medically significant component of blood, a blood fraction or a control.

48. The apparatus of claim 47 for performing the first measurement on the blood, blood fraction or control which first measurement varies with both the concentration of glucose and the concentration of blood cells in blood, a blood fraction or a control.

30 49. The apparatus of claim 48 for performing the second measurement on the blood, blood fraction or control which second measurement

varies primarily only with the concentration of blood cells in the blood, blood fraction or control.

50. The apparatus of claim 49 for performing the second measurement of a largely glucose-insensitive measure of hematocrit.

51. The apparatus of claim 50 for performing the first measurement of a hematocrit-sensitive measure of glucose concentration.

52. The apparatus of claim 28 wherein the device for performing a first measurement on the biological fluid or control which first measurement varies with both the concentration of the first component and at least one of the presence and 10 concentration of the second component includes a device for performing measurements of a time-varying function $i_1(t)$ having the general form

$$i_1(t) = M/\sqrt{t} + B$$

where t is time from initiating the measurement, M is the slope of a graph of the function and B is a value the function approaches as t becomes very large.

15 53. The apparatus of claim 28 wherein the device for performing a second measurement on the biological fluid or control which second measurement varies primarily only with the at least one of the presence and concentration of the second component to develop an indication of the at least one of the presence and concentration of the second component includes performing at least one measurement 20 of a time-varying function $i_2(t)$, where t is time, $t <$ some arbitrarily established time.

54. The apparatus of claim 28 wherein the device for performing a first measurement on the biological fluid or control which first measurement varies with both the concentration of the first component and at least one of the presence and concentration of the second component, performing a second measurement on the 25 biological fluid or control which second measurement varies primarily only with the at least one of the presence and concentration of the second component to develop an indication of the at least one of the presence and concentration of the second component, and removing an amount representative of the indicated presence or concentration of the second component from the concentration of the first component indicated by the first measurement includes a device for performing measurements of 30 a time-varying function $i_1(t)$ having the general form

$$i_1(t) = M/\sqrt{t} + B$$

where t is time from initiating the measurement, M is the slope of a graph of the function and B is a value the function approaches as t becomes very large, performing at least one measurement of $i_2(t)$, $t <$ some arbitrarily established time, and removing from the measurements of $i_1(t)$ the at least one measurement of $i_2(t)$.

- 5 55. A method for substantially concurrently determining the concentrations of first and second medically significant components of a biological fluid or a control during an assay of a sample of the biological fluid or control, the method including developing an equivalent electrical circuit model of a sample of the biological fluid or control and an apparatus for assaying the biological fluid or
- 10 control, identifying at least a first element of the electrical circuit model, the behavior of which at least first element varies with the concentration of the first component relatively independently of the concentration of the second component, identifying at least a second element of the electrical circuit model, the behavior of which at least second element varies with the concentration of the second component relatively
- 15 independently of the concentration of the first component, separately assessing the behaviors of the at least first element and the at least second element during the assay, and determining from the separate assessments of the behaviors of the at least first element and the at least second element the concentrations of the first component and the second component.
- 20 56. Apparatus for substantially concurrently determining the concentrations of first and second medically significant components of a sample of a biological fluid or a control during an assay of the sample, the combination of the apparatus for assaying the sample and the sample together characterized by an equivalent electrical circuit model including at least a first element, the behavior of
- 25 which at least first element varies with the concentration of the first component relatively independently of the concentration of the second component, the equivalent electrical circuit model further including at least a second element, the behavior of which at least second element varies with the concentration of the second component relatively independently of the concentration of the first component, the apparatus
- 30 including a device for separately assessing the behaviors of the at least first element and the at least second element during the assay, and determining from the separate

assessments of the behaviors of the at least first element and the at least second element the concentrations of the first component and the second component.

57. A method for substantially concurrently determining the concentrations of first and second medically significant components of a biological fluid or a control during an assay of a sample of the biological fluid or control, the method including developing an equivalent electrical circuit model of a sample of the biological fluid or control and an apparatus for assaying the biological fluid or control, identifying at least a first element of the electrical circuit model, the behavior of which at least first element varies with the concentration of the first component
- 10 relatively independently of the concentration of the second component, identifying at least a second element of the electrical circuit model, the behavior of which at least second element varies with the concentrations of both the first and second components, separately assessing the behaviors of the at least first element and the at least second element during the assay, and determining from the separate assessments
- 15 of the behaviors of the at least first element and the at least second element the concentrations of the first component and the second component.

58. Apparatus for substantially concurrently determining the concentrations of first and second medically significant components of a sample of a biological fluid or a control during an assay of the sample, the combination of the
- 20 apparatus for assaying the sample and the sample together characterized by an equivalent electrical circuit model including at least a first element, the behavior of which at least first element varies with the concentration of the first component relatively independently of the concentration of the second component, the equivalent electrical circuit model further including at least a second element, the behavior of
- 25 which at least second element varies with the concentrations of both the first and second components, the apparatus including a device for separately assessing the behaviors of the at least first element and the at least second element during the assay, and determining from the separate assessments of the behaviors of the at least first element and the at least second element the concentrations of the first component and
- 30 the second component.